THE FACTS ABOUT

The Bay Cities Water Company's

WATER SUPPLY FOR SAN FRANCISCO

AN ADDRESS BEFORE THE

COMMONWEALTH CLUB

ON MARCH 13, 1907

—BY—

EDWIN DURYEA, Jr., *M. Am. Soc. C. E.*

CHIEF ENGINEER OF THE COMPANY

—ALSO—

A COMPLETE AND EXACT COPY

—OF THE—

PROPOSITION MADE BY THE BAY CITIES WATER COMPANY TO THE BOARD OF SUPERVISORS

ON APRIL 9 AND MAY 21, 1906

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An Address Before the COMMONWEALTH CLUB on March 13, 1907, by Edwin Duryea, Jr., M. Am. Soc. C. E., Chief Engineer of the Company.

COMMONWEALTH CLUB

DISCUSSION ON WATER-SUPPLY OF SAN FRANCISCO.

THE FACTS ABOUT THE BAY CITIES WATER COMPANY'S PROJECT,

by Edwin Duryea, Jr., M. Am. Soc. C. E.,
Chief Engineer of the Company.

March 13, 1907.

I have been invited by the Club to present the facts about the Bay Cities Water Company's project of a water-supply for San Francisco and shall therefore say but little on other phases of the subject. The need of San Francisco for a larger and better water-supply than it now has, and for municipal ownership of its supply, seems so self-evident as to be hardly worth discussion. It seems equally evident that the new supply should be from the Sierras—and the only debatable question is which one of the several Sierra supplies will best meet the needs of San Francisco.

Of the various Sierra supplies, but two are prominently mentioned at present as water-supplies for San Francisco. These two are the Tuolumne supply, advocated by Mr. James D. Phelan, former Mayor of San Francisco, and the American-Cosumnes supply, owned by the Bay Cities Water Company.

But brief comments will be made on the Tuolumne supply, (1) to show the improbability of San Francisco being able to acquire it and (2) to correct two of the misstatements made by Mr. Phelan in regard to it, both in his present discussion and previously in newspapers. As to its acquirement, it should not be forgotten that no matter what the merit of the Tuolumne as a source of water-supply for San Francisco (and I believe it to have much merit), the United States Government has several times refused San Francisco permission to use it for that purpose. Such a permission would be not only contrary to the established policy of the Government, but in direct disregard of the protests of agriculturists in the valley below, dependent on irrigation. The Government doubtless realizes that its adverse decision entails no more serious consequence to San Francisco than the necessity of adopting some other of the several Sierra supplies, as good as the Tuolumne but perhaps a little more costly. Should any reservoir privileges be granted, the Modesto-Turlock Irrigation District, served by water from the Tuolumne, would be the interest most likely to receive them. Large sums have been spent in perfecting this irrigation system, which cannot, as can San Francisco, use other streams than the Tuolumne. The District has already, I believe, applied to the National Government for reservoir privileges on the Tuolumne.

To all except ardent partisans of the Tuolumne supply, its acquirement by San Francisco seems impracticable and still as far distant as when the effort to acquire it was begun, about six years ago.

The misstatements of Mr. Phelan which will be corrected are as follows:

First, he states that the area contributing to the Tuolumne supply contains "more than 1500 square miles," though the fact is that the combined catchment-area of the Lake Eleanor and Hetch Hetchy reservoirs contains but 536 square miles. (See Report of C. E. Grunsky, City Engineer, Municipal Reports, San Francisco, 1902-03, pp. 414 and 416). The misstatement probably arose from confusing the area above the Government Gaging Station at La Grange, 1501 square miles, with the area above the point where the San Francisco supply would leave the river, many miles further up-stream. The correction of this misstatement shows the true water-producing area of the "Tuolumne Supply" to be only 36 per cent. of that claimed by Mr. Phelan.

The other misstatement relates to the run-off or stream-flow of the Tuolumne. Mr. Phelan states that the Tuolumne catchment-area has a "mean annual rainfall of from 20-50 inches" and a "mean annual run-off of 24 inches." Mr. Grunsky states (see his Report, pp. 420 and 423, S. F. Munic. Rep., 1902-03) that both the Lake Eleanor and the Hetch Hetchy catchment-areas have average mean annual rainfalls of about 36 inches, with a mean annual run-off of about 14 inches. He also says "the minimum (rainfall) may be as low as 18 inches per annum" and "for a season of minimum precipitation, when the fall of rain and snow throughout the watershed may be equivalent to only 18 inches of rain, it is estimated that the run-off would be about 5.4 inches." The date of Mr. Grunsky's report was July, 1902. Later studies by him, embodied in an official drawing dated February, 1904, show that his final conclusion is that with Sierra conditions an 18-inch rainfall cannot be safely depended upon to yield more than 3.4 inches of run-off. I may add that I have discussed this drawing (entitled *Revised* Run-off Curves) with him verbally and was told that it embodied his latest and most reliable data of run-off, and should be used in preference to any of his earlier conclusions.

Instead, therefore, of an average annual run-off of 24 inches from the Tuolumne area, as claimed by Mr. Phelan, Mr. Grunsky claims only 14 inches, or only 58 per cent. as much. The *average* run-off has but little bearing on water-supply, however, as for that purpose only the worst conditions, or the minimum run-off, can be considered. According to Mr. Grunsky's conclusions the value of the Tuolumne for water-supply is represented by 5.4 inches run-off (in his report of 1902), or more accurately by 3.4 inches (in his Revised Run-off Curve of 1904). These values are respectively 23 per cent. and 14 per cent. of the 24 inches average run-off mentioned by Mr. Phelan.

If the above error in run-off is combined with the error in area, the product of the 14 per cent. by the 36 per cent. gives about 5 per cent. as the relation between the actual water-producing value of the Tuolumne and that corresponding to the area and the average run-off mentioned by Mr. Phelan. It is to be regretted that both Mr. Phelan and his engineering coadjutor, Mr. Manson, were ignorant of these errors, since their effect has been to make the water-supply of the Tuolumne appear to the public (which knows nothing of the distinction between average and minimum run-off) about twenty times as great as is really the fact. Even comparing average years, Mr. Phelan's statement of 24 inches run-off from 1500 square miles and Mr. Grunsky's claim of only 14 inches from 536 square miles make the water-production of the Tuolumne supply in average years about five times as great, according to Mr. Phelan, as claimed by Mr. Grunsky.

Before leaving this brief consideration of the Tuolumne, it will be of interest to compare its water-producing capability with that of the American-Cosumnes area of the Bay Cities Water Company.

The latter area comprises 396 square miles of Sierra territory, on the South Fork of the American River and the North Fork of the Cosumnes River. It has mean annual rainfalls varying in different parts from 45 inches to over 70 inches, the average for the whole area of 396 square miles being 59.7 inches. These mean rainfalls are from the map of the California Water and Forest Association, 1900, Marsden Manson, C. E., used in conjunction with all available subsequent information. The final result of 59.7 inches mean annual rainfall is reliable, being confirmed, among other local data, by rainfall observations of from one to six years duration at eight stations within the catchment-area.

It is worthy of mention that the rainfall lines of the Water and Forest Association Map give a mean annual rainfall of 49.3 inches for the Tuolumne area. However, as Mr. Grunsky's report of 1902 was written two years after the publication of that map and with a full knowledge of it, it may be presumed that he doubted the correctness of its rainfall lines over the Tuolumne area. His statement of the mean annual rainfall of the Tuolumne, 36 inches, will be used in the comparison.

The comparison can best be shown by tabulation, as below. The sources of most of the data have already been mentioned—being Mr. Grunsky's Report of 1902, his Revised Run-off Curves of 1904, the Water and Forest Association Map of 1900, U. S. Government Contourmaps, etc., etc. The minimum annual rainfall (snow included) is taken as half of the mean, as was done by Mr. Grunsky for the Tuolumne.

ITEM	TUOLUMNE	AMERICAN-COSUMNES
Catchment Area	536 sq. miles=100%	396 sq. miles = 74%
Mean Annual Rainfalls vary from	20 ins.-50 ins.	45 ins. - over 70 ins.
Average Mean Annual Rainfall	36 ins. =100%	59.7 ins. = 166%
" Minimum " " (½)	18 ins. =100%	29.8 ins. = 166%
Mean Annual Run-off (Average)	14.0 ins. =100%	32.0 ins. = 229%
Minimum " " (")	3.4 ins. =100%	9.9 ins. = 291%
Catch. Area x Av. Mean Run-off=	100% x 100%=100%	74% x 229% = 168%
" x " Min. " =	100% x 100%=100%	74% x 291% = 215%

It is thus seen that the dependable stream-flow or water-producing capability of the Bay Cities Water Company's Catchment-area is in average years over one and two-thirds times as great as that of the Tuolumne, while in years of least rainfall (the only ones to be seriously considered in relation to water-supply) it is more than twice as great.

A brief consideration of the American-Cosumnes Project of the Bay Cities Water Company will now be made on its own merits, regardless of other sources of supply.

In considering the advisability of acquiring a system of City water-supply, the questions which arise are physical, legal and financial and may be formulated somewhat as follows:

(1) Will the system furnish, and continue to furnish, an ample and reliable supply of pure water?

(2) If physically satisfactory, can valid rights to the water and the system be acquired by the city?

(3) If physically desirable and legally acquirable, will the benefits secured by the purchase be commensurate with its cost to the city?

My investigations as engineer of the Bay Cities Water Company have dealt with the first of these questions. The second can be answered conclusively only by lawyers. I shall say nothing regarding it except that this question was investigated by competent lawyers before the Bay Cities Water Company acquired any rights in the American-Cosumnes Project, and the Company was advised that its contemplated investment could safely be made and that the use of these waters for a San Francisco supply could give rise to no serious legal objections, provided the contracts for supplying water which are yet unexpired be carried out; and that the Company is under no obligation to renew such contracts when they expire. There will be no necessity of ceasing to serve the present users of the water, however, as the Bay Cities Water Company controls other water-properties, not available in connection with its proposed San Francisco supply, which are ample for these needs. The third question—the relation between benefit and cost—rests for its final decision with the voters of San Francisco. I shall, however, give a few facts which may aid in the decision.

As to the physical facts of the American-Cosumnes Project I am able to speak with full authority, having spent in engineering studies of the project not only about a year net of my own time, but nearly two years time of a large, expensive and efficient engineering department. It was realized in the beginning that the full facts could be obtained only by patient, honest and long-continued engineering surveys and investigations and that such work is necessarily costly; and while all money was expended with care, the cost of obtaining the necessary data was never allowed to prevent its acquirement. The cost to San Francisco of its investigation of the Tuolumne supply is said to have been $40,000. The Bay Cities Water Company has already expended a still larger sum in the engineering investigation of its American-Cosumnes Project—and has secured data for use in connection either with city water-supply or the development of hydraulic power well worth its great cost.

The chief physical facts to be learned about a new water supply are (1) as to the purity of the water and the probability of its so continuing; (2) the amounts of rainfall and stream-flow which may be depended on in the worst years, with their distributions; and (3) the number, distribution and individual and aggregate capacities of the various practicable reservoir-sites within the catchment-area. The results of my engineering investigations of the Bay Cities Water Company's project will be given very briefly under these headings.

The first consideration in a water-supply is the purity of its water. Conclusive proof has been obtained of the purity of the American-Cosumnes supply by analyses of samples of the water from Silver Lake, Echo Lake, the American River at the head of the Canal and the Cosumnes River at Buck's Bar. These samples were taken in the fall of 1905, when the water in the streams was at its lowest stage and the number of campers greatest. The report of the chemists (Thomas Price and Son) shows all the samples to be of unusual purity—even that from Buck's Bar, the lowest point on the catchment-area and the only one with the remotest probability of contamination. Quoting from their report, "The foregoing analyses show these waters to possess a degree of purity which is not equalled by that supplied to any large city in the world."

This conclusion could be confidently expected, as unprejudiced engineers know the water from all Sierra sources to be of unusual purity except where contaminated by mining camps,wastes from mines, and human habitations. There are no mines (and no permanent population of any kind) on the 238 square miles of American River territory, while on the 158 square miles of Cosumnes territory there are no operating mines and only one mine, with 15 men employed, doing prospecting work. The mining activity in all this region has been decreasing for years past, as has the population within the Cosumnes catchment-area. Neither is there any likelihood of a revival of the mining (never of any magnitude), as the Mariposa slates of the Mother Lode do not extend so far eastward and the small amount of hydraulic mining done in earlier years is now permanently discouraged by the debris laws.

Whether shown pure by analysis or not, the uninterrupted safety of any catchment-area for purposes of city water-supply may be judged relatively by its number of inhabitants. Catchment-areas with large populations can be so inspected and regulated as to make their water entirely safe for city use (the water-supply of New York, a very healthy city, is now furnished from a catchment-area having 10,000 population); but on the other hand, a slack inspection or regulation of populated areas may lead to serious epidemics, while very sparsely inhabited or uninhabited areas are beyond suspicion and practically beyond need of inspection or regulation.

The catchment-areas of the Bay Cities Water Company are practically uninhabited. From careful estimates of population, made independently by different people and agreeing closely with each other and with County records, it is known that the American River Catchment-area has absolutely no permanent inhabitants except three ditch-tenders and their families, while its population during the summer months (including guests at hotels but not including campers) is only about 65 on its area of 238 square miles. During the summer months the population of the Consumnes Catchment-area is only about 305 (including guests at hotels but not including campers). During the winter its population is still less. Of these 305, about 100 are at Grizzly Flat and 120 at Pleasant Valley. Neither Grizzly Flat nor Pleasant Valley territory need be included within the catchment-area utilized for a San Francisco supply for many years to come, and when they are included the Pleasant Valley population will be almost entirely wiped out by a reservoir which should be located on the site of the slowly dying village, while Grizzly Flat will be about ten miles from the next reservoir below.

As to the summer campers, their number is not great and is certainly negligible in comparison with the large and constantly increasing number of tourists who visit the Tuolumne each summer.

To conclude these few remarks as to the purity of the American-Cosumnes water and the freedom of its catchment-area from contaminating influences, chemical analyses show the water to be pure at present; the population is less than one per square mile during even the summer months and this population is decreasing; and the recent extension of the forest-reserve limits to cover 249 square miles of the catchment-area will tend to still further decrease its use for human habitations.

The investigations under the second heading—Amounts of Rainfall and Stream Flow—made use of all published data, also of all other data that could be secured. The published data consists mainly of records of rainfall and stream-flow of Sierra territory for years past, as contained in the publications of the U. S. Weather Bureau and the U. S. Geological Survey. Among the unpublished data are records of rainfall and stream-flow taken with great care by the Standard Electric Company and worked up under my own direction by the engineer in charge of the observations; also rainfall and stream-flow measurements taken by my own assistants, these observations being still in progress. The published rainfall data which appeared doubtful was carefully examined into. In one intsance (Shingle Springs) the original record, kept by an English physician, was hunted down by tracing the movements of a son of the observer until he was found in Sacramento and from him obtaining the original record-book kept by his father, showing the rainfall at Shingle Springs for 1849 and many years thereafter.

The physical data collected under my own direction consists not only of rainfall, snow-fall and stream-flow observations on the catchment-area, but also of surveys of twenty-four separate reservoir-sites and dam-sites, and of canal locations and tunnel locations. These surveys were begun in the fall of 1905 and continued and completed, by four survey parties, in the summer and fall of 1906.

Data only has so far been referred to. Such data is absolutely essential to the careful investigation of a water-supply, but it is only preliminary to the real investigation and no more important than the subsequent working out of the problem. The latter is indeed much the higher class of engineering work. It is a popular error to look on surveying as synonymous with civil engineering. This idea is entirely erroneous, surveying being merely a means of collecting a certain class of data for the use of civil engineers. The real engineering consists in making use of such data, by proper methods, to form definite and reliable conclusions. While much time and great cost has been expended by the Bay Cities Water Company in acquiring data in the field, still more time and cost has been expended in carefully and conscientiously working up such data in the office. It cannot be expected that a two years' investigation will be described in a few minutes in a short paper, therefore I will close the consideration of the amount of water which can be supplied for City use by a proper development of the American-Cosumnes Catchment-area by giving a list of the results of the investigation, without further comment than to say that all results were worked out with great care and with an honest effort to ascertain the truth without favor to the Bay Cities Water Company.

The reservoir surveys show that an aggregate water-storage of 104,900 million gallons may be secured in eighteen reservoirs. These reservoirs are all practicable and can be created by dams of practicable height and cost. Six other reservoir sites were surveyed, but were rejected because their capacity was too small to justify the cost of their dams.

The investigation shows that by the combined use of the stream-flow and above reservoir storage, a continuous and dependable water-supply of over 317 million gallons per day can be furnished throughout the dryest year known. It also shows that 198 million gallons of this total would be furnished by the fully developed American River area alone, or 215 million gallons if the Sly Park area of the Cosumnes is added; and 119 million gallons by the developed Cosumnes area. Also that the combined American-Cosumnes area, excluding only Pleasant Valley and Buck's Bar reservoirs and their tributary areas, can be depended upon to furnish a continuous daily supply of 242 million gallons throughout the dryest years.

From an extension of Professor Marx' estimate, San Francisco will require a daily water-supply of 317 million gallons in about 1975, or say 70 years in the future. From an extension of a published estimate by Mr. Schussler, this amount of water will not be required until about 2030, or until say 120 years hence. Professor Marx' and Mr. Schussler's estimates of future population, extended, show a population of 3,000,000 people in the years 1995 and 2040 respectively; and this population, at a per capita consumption of 100 gallons per day (much more than now used) would nearly exhaust the 317 million gallons daily supply. It therefore appears that should San Francisco acquire the American-Cosumnes project of the Bay Cities Water Company, she would not (even if her present supply be left out of consideration) find it necessary to seek an additional source of supply for at least 70 years to come and perhaps not for more than 100 years.

The final consideration mentioned—what San Francisco will get in return for its cost should she purchase the American-Cosumnes Project of the Bay Cities Water Company—will now be treated briefly. To begin with, her purchase will give her the water-rights, many of them in use for more than thirty years past, on 396 square miles of Sierra territory having a high rainfall and stream-flow, and 249 square miles of which are now within the U. S. Forest Reserve. These water-rights include property or flowage-rights to numerous reservoir-sites as well as the right of diversion from the streams, and give the city control of all natural features necessary for the development and control of a water-supply with an ultimate capacity of 317 million gallons per day throughout the dryest years. Also, incidentally, a water-power development is practicable of over 50,000 Theoretical, or over 30,000 Salable Horse Power.

In addition to the property and flowage-rights and the undeveloped water-supply resources which San Francisco would secure, she would at once become possessed of a developed catchment-area capable of furnishing over 88 million gallons per day of water at the head of a pipe-line leading to San Francisco, and of furnishing over 16,000 Theoretical, or over 10,000 Salable, Horse Power from the water. The completed structures necessary to this water-development and in which she would at once acquire property rights would be briefly as follows:

FIRST. An existing dam at Silver Lake impounding 1950 million gallons.

SECOND. An existing dam at Echo Lakes, impounding 700 million gallons, with a short flume and tunnel to conduct water from the Lakes into the head waters of the American River.

THIRD. An existing dam impounding 800 million gallons of water in the Medleys reservoir.

FOURTH. A concrete-steel diversion dam 34 feet high on the South Fork of the American River at Slippery Ford, to divert water from the stream-bed into the American Canal.

FIFTH. Concrete-steel head-works to this canal, 25 feet in height.

SIXTH. Over seventeen miles of the American Canal enlarged to carry 100 million gallons per day, and with flumes, trestles, sand-boxes, waste-wiers and all appurtenances complete.

SEVENTH. The Pacific House Tunnel, about 2100 feet in length, to divert the waters of the American Canal through the ridge into the Cosumnes Catchment-area above Sly Park. This tunnel is to be of a capacity of 200 million gallons per day and to be furnished with proper head-gates, etc., to control the inflow of the water.

EIGHTH. The fully developed Sly Park Reservoir, of over 11,000 million gallons capacity. This reservoir would be created by two earth dams, one 161 feet in height and the other 92 feet in height; with the necessary spill-way, outlet tunnels, gate-house, etc.

NINTH. A concrete-steel diversion dam 23 feet high in Camp Creek, to divert the waters from Sly Park Reservoir into the High-Line Canal; also the necessary outlet tunnel, head-works, etc., to pass the water from behind the diversion dam into the High-Line Canal.

TENTH. The High-Line Canal, about 15 miles in length, enlarged to carry 100 million gallons per day and provided with necessary appendages such as flumes, trestles, sand-boxes, relief gates, etc., and including a tunnel of about 1000 feet in length.

It is thus seen that if the Bay Cities Water Company's Project be purchased, the City would not only acquire ownership in lands and rights sufficient to provide water for nearly a hundred years to come, but would also acquire works which would be ample to provide its water supply for at least twenty-five years to come. The additional works necessary to increase the developed supply from 88 to 317 million gallons per day would be of relatively low cost and need be added only gradually, throughout a period of seventy or eighty years.

The offer of the Bay Cities Water Company now before San Francisco provides only for bringing the water to the head of a pipe-line leading to the city. Before the city can make use of this water it must be carried many miles in an expensive conduit. In deciding upon the relative merits of two projects for the water-supply of San Francisco, not only the relative costs of the two developed catchment-areas must be considered but also the relative costs of their respective conduits to the City. This was recognized by the Bay Cities Water Company and months of careful study were expended on investigations for a pipe-line from the terminus of their proposed works to San Francisco. Nothing more will be said of this pipe-line investigation than that good data were secured for it and the problem worked out in a very pains-taking and thorough manner. The result of the investigation, stated very briefly, is that the American-Cosumnes supply can be connected with San Francisco by a pipe-line around the south end of the Bay which will be over eighteen miles shorter than the conduit from Tuolumne proposed by Mr. Grunsky; and that the American-Cosumnes pipe-line, with a carrying capacity 22 per cent. greater and a factor-of-safety (margin of strength) 25 per cent greater than the Tuolumne pipe-line proposed by Mr. Grunsky, can be completed for about four million dollars less than his estimated cost for the Tuolumne conduit.

In conclusion, it is extremely improbable that the Tuolumne supply can ever be secured by San Francisco, and if secured it will yield less than half as much stream-flow as will the American-Cosumnes area. The partisans of the Tuolumne supply have repeatedly claimed for it, in comparing it with the American-Cosumnes, that it would be without cost to San Francisco. This is not a fact. Even if the Tuolumne could be secured from the Government and were the best source of supply of any, large sums must be expended for dams and canals before a water-supply is developed; while the offer of the Bay Cities Water Company includes the transfer to the City not only of lands and water-rights, but also of all the completed structures necessary to develop a water-supply one-half greater than Mr. Grunsky's proposed Tuolumne supply.

The American-Cosumnes Project of the Bay Cities Water Company offers to San Francisco a supply of pure water, from a practically uninhabited region, sufficient in quantity to serve the city for perhaps a hundred years to come. It offers not only a much larger immediate supply than that proposed by Mr. Grunsky from the Tuolumne, but also at no great increase in cost, for a system completed to San Francisco, above his estimate for the completed Tuolumne system. The capability and practicability of the American-Cosumnes area as a source of water supply for San Francisco has been thoroughly studied and the results placed in form for quick investigation by others. Finally, it has a very decided advantage over the Tuolumne in being controlled by one corporate interest and hence free to be acquired by San Francisco at once, without long delay and probably ultimate failure in attempting to secure permission to use it from the Government; and what San Francisco needs if her prosperity is to be uninterrupted is not only a larger and a better water-supply than she now has, but also that one shall be acquired with the least possible delay.

EDWIN DURYEA, JR., M. Am. Soc. C. E.,
Chief Engineer Bay Cities Water Co.

San Francisco, Cal., March 11, 1907.

A Complete and Exact Copy
# of the
PROPOSITION MADE BY THE BAY CITIES WATER COMPANY TO THE BOARD OF SUPERVISORS
on
April 9 and May 21, 1906.

April 9, 1906.

To the Honorable the Board of Supervisors of the City and County of
San Francisco.

GENTLEMEN:—

In conformity with the conditions set forth in Resolution No. 7130, adopted by your Honorable Body on the 12th day of March, 1906, Bay Cities Water Company, a corporation under the laws of California, respectfully submits the following proposition for your consideration.

For the price hereinafter set forth Bay Cities Water Company proposes to vest in the City and County of San Francisco certain water rights, reservoir rights, water-storage rights, reservoirs, reservoir sites, dams, canals, flumes, ditches and tunnels, rights of way and power house site, together with existing improvements, and further improvements to be made thereon under this proposition, said rights and properties being located in El Dorado, Amador and Alpine Counties, California.

These rights and properties present the following important features, all of which have been conclusively established by the most accurate and detailed investigation of eminent hydrographic engineers, who have been employed upon this work by proponent company for many months past:

FIRST. That the water rights are fundamental and so control the waters naturally flowing in the South Fork of American River and its tributaries above the intake of the El Dorado Water and Deep Gravel Mining Company's canal, and of the North Fork of the Cosumnes River and its tributaries above Buck's Bar; that these waters may be taken to the extent of two hundred or more million gallons per day. See schedule of Water Appropriations marked "Exhibit A".

SECOND. That all desirable water-storage rights within the drain area tributary to the South Fork of American River and North Fork of Cosumnes River, above the points named, heretofore secured by location and appropriation, have been acquired and are comprehended by and included within this proposition. See schedule of Water Reservoir Locations marked "Exhibit B".

THIRD. That the reservoirs embraced within this proposition, including those now constructed and such as these proponents will construct at their own cost under this proposition, have an aggregate storage capacity for reserves against a continuing daily draft of seventy-five million gallons of water. See schedule of Reservoirs marked "Exhibit C".

FOURTH. That when the existing and proposed reservoirs shall be suitably and practicably enlarged and additional reservoirs created upon other available sites, they will comprise storage for that quantity of water requisite to a continuing daily draft of two hundred million gallons of water. See schedule of Additional Reservoir Sites marked "Exhibit D".

FIFTH. That the dams creating the existing reservoirs, and those to be erected by proponents under this proposal, comprise all dams that will be required until such time as the water consumption of the city shall exceed seventy-five million gallons of water per day. See schedule of Dams marked "Exhibit E".

SIXTH. That the existing canals, ditches and tunnels, together with such improvements thereon and additions thereto as proponents will make under this proposal, comprise a system of conduits sufficient for the concentration at a common point, hereinafter referred to, of a quantity of water sufficient to provide a continuing daily draft of seventy-five million gallons. See schedule and brief description of Canals, Ditches and Tunnels marked "Exhibit F".

SEVENTH. That the natural channels, canals and rights of way embraced within this proposition, are such as will be required for collecting waters from the various storage reservoirs and delivering the same at a common point, to the extent of providing at that point a continuing daily draft of two hundred or more million gallons. See schedule marked "Exhibit G".

EIGHTH. That the lands and properties embraced within this proposition and to which fee simple title is to be conveyed to the City and County of San Francisco, embrace various canals, ditches, reservoir land and timber lands, inclusive of a tract of adequate area and suitable location for power generating station and head-works for pipe lines leading therefrom to the City and County of San Francisco. See Property Maps 1, 5, 6, 7, 8, 9, 10 and 11.

NINTH. That this proposition embraces stumpage contracts upon timber lands and easements upon lands privately owned that are required for use in connection with the ultimate conservation and delivery at the upper end of pipe lines leading to the city, of a continuing daily draft of two hundred million gallons of water. See Property Maps 1, 3, 5, 8, 9, 10 and 11.

TENTH. That this proposition also embraces the right to use all lands belonging to the United States Government the use of which has been heretofore granted to proponent and its predecessors, which are essential to the conservation and delivery of a daily supply of two hundred or more million gallons of water as aforesaid. See Property Maps 1, 2, 3, 4, 7 and 9.

ELEVENTH. That the watersheds, the runoff from which is controlled through ownership and control of the water rights, reservoirs and reservoir sites referred to, have the capacity requisite to the production of water in sufficient quantities to provide against a continuing daily draft of two hundred or more million gallons of water per day. See Description of Watershed marked "Exhibit H" and engineering data to be submitted.

TWELFTH. That the daily water supply of seventy-five million gallons above referred to, will be delivered at such an elevation above the headworks of pipe lines leading to the city as to enable the development therefrom of such power as may be required to force that quantity of water through the pipe lines leading to the City and County of San Francisco, and all other electric power necessarily incidental. Also that when the additional improvements necessary to a daily supply of two hundred million gallons are made, that such additional power as will then be required for the same purpose can readily be developed from the water at the same point.

THIRTEENTH. That the point at which the two hundred million gallons of daily water supply can be concentrated under this proposal, consists of a tract of at least forty acres of land located upon the banks of the North Fork of Cosumnes River in El Dorado County, California, about one hundred and twenty miles from San Francisco. And that it possesses the natural advantages requisite to a site for power generating stations, and the intake of pipe lines for the purpose of conveying water therefrom to the City and County of San Francisco. See Property Map No. 11.

FOURTEENTH. That the water procurable from the sources embraced within this proposition, is such as usually originates upon the high, rocky mountains of the Sierra Nevada range; that it is soft, possessed of an unusual degree of purity and is in every respect as desirable for human consumption and general use as any water in the State of California, or elsewhere in the world. See Analyses of the Water marked "Exhibit I".

FIFTEENTH. That the improvements now existing upon said properties, together with those which these proponents will make thereon at their own cost under this proposal, will be such as to amply provide at the point of intake of pipe lines to San Francisco, against a continuing draft of seventy-five million gallons of water per day. A schedule of the improvements to be made by and at the cost of these proponents under this proposal, is hereto attached and marked "Exhibit K".

NOW THEREFORE, BAY CITIES WATER COMPANY, a corporation under the laws of California, under this proposition offers to the City and County of San Francisco

(1) All rights existing under and by virtue of the several water and reservoir site appropriations set forth in Exhibits A and B hereto attached. Also

(2) All the reservoir sites specified and described in Exhibits C and D hereto attached, together with the dams now existing and to be

constructed by these proponents under this proposal, described in Exhibit E. Also the betterments and improvements described in said last named exhibit and in Exhibit K. Also

(3) All the several tunnels, canals, ditches, flumes and conduits described in Exhibit F hereto attached, inclusive of the tunnel to be constructed by these proponents connecting the American and Cosumnes watersheds, as described in said exhibit and in Exhibit K. Also

(4) The several rights of way for the construction of canals, ditches, etc., described in Exhibit G hereto attached. Also

(5) A fee simple title to the several tracts of land indicated upon Property Maps 1, 5, 6, 7, 8, 9, 10 and 11. Also

(6) Easements upon the several tracts of land indicated upon Property Maps 1, 3, 5, 8, 9, 10 and 11. Also

(7) The rights acquired from and ceded by the United States Government, upon the several tracts of land indicated upon Property Maps 1, 2, 3, 4, 7 and 9. Also

(8) All of the improvements to be made upon said properties described in Exhibit K hereto attached.

ALL OF THE FOREGOING RIGHTS AND PROPERTIES, together with the improvements now existing thereon and such as are to be made thereon by these proponents in accordance herewith, to be conveyed to, and delivered into the possession of the City and County of San Francisco by these proponents for the gross purchase price or sum of ten million five hundred thousand ($10,500,000) dollars to be paid to these proponents, their successors or assigns, in United States gold coin at such times and in such payments as may be agreed upon between the Board of Supervisors of the City and County of San Francisco and your proponents, upon the acceptance of this proposition.

For the purpose of comparison merely and of accentuating the value and desirability of this water supply for the City and County of San Francisco, the proponents request your Honorable Board to consider it in relation to the most prominently mooted and heretofore best known proposed municipal water supply, namely, that known as the Hetch Hetchy or Tuolumne system recommended by former City Engineer Grunsky and recently again endorsed by ex-Mayor Phelan.

#1—PRICE. The Tuolumne scheme, assuming that titles and permits can be obtained, would according to the official estimate of Mr. Grunsky, cost the city $39,531,000. This includes the city distributing system. Based on the figures and estimates found in Mr. Grunsky's report on the Tuolumne project, the cost of the water system submitted by proponents, *from the point of intake where the pipe lines to the city commence,* including all pipe lines, pumping plants, safety reservoirs and city distributing system, would not exceed $27,500,000, and might be constructed for considerably less.

Taking the last named figure, however, as a basis, the total cost of the project herewith submitted—complete—would be $38,000,000, making a saving over the proposed Tuolumne supply of over one and one-half million of dollars.

#2—QUANTITY OF WATER. The uninterrupted continuous daily supply furnished from this project on first development, would be seventy-five millions of gallons as against sixty million gallons contemplated by the Tuolumne scheme. Moreover, storage capacity and rights developable to a daily continuing and constant supply of two hundred millions of gallons are included without extra charge to the city, as against a possible maximum development from the Tuolumne of one hundred and sixty million gallons per day.

#3—TITLE. The city will own its own property, its own water, its own reservoirs and its own rights of way, if it shall acquire the property herein submitted. Whereas in the proposed Tuolumne supply it is doubtful whether any satisfactory or sufficient rights will ever be conferred on the city by the Federal Government; and even if such rights should eventually and after additional years of further delay and difficulty be obtained, they might not be permanent and they probably would never amount to a title. We propose to convey and to vest in the city an absolute title as heretofore specified.

#4—QUALITY OF WATER. It is absolutely free from pollution and of the purest mountain sources.

#5—EXPEDIENCY. The waters in this proposed system are taken from the Northern Sierras and from districts everywhere amply supplied with necessary water for irrigation, for industrial enterprises and for domestic purposes. The taking of these waters for San Francisco will make no substantial change or cause any appreciable loss or damage to any of the people engaged in developing the wealth and resources of the State—to the ultimate benefit and advantage of the City of San Francisco; while the taking of the waters of the Southern Sierras as is contemplated by the Tuolumne project, would inevitably bring suffering and injury to and inflict irreparable damage on the vast mining and agricultural industries of the Southern and Central portions of our State,—none too well supplied even now with the prime necessity of their industrial life—pure fresh water—in sufficient quantities for constant and continuous use.

It is this consideration which has moved large bodies of the population of that section of our State to protest against the diverting of their natural water supplies from their own to this city's use; and it is their protest, based on these considerations, which has been given such official heed by the Government officers at Washington as to have prevented San Francisco up to this date, from making any satisfactory progress in the acquisition of the rights necessary to create and develop this Tuolumne scheme of water supply. And irrespective of any legal rights, it would seem to these proponents that the City of San Francisco, seeing its own interests in the fruitful and steady development of the interior portions of our State, would, aside from any ground of sentiment, exercise a wise judgment in securing its water supply from points where neither State development nor private citizen's prosperity would be menaced by the taking of the waters, and preferentially seek its water supply from the abundant and copious sources of the Northern Sierras—scantily drawn upon for local needs—rather than from the sparser supplies of the Southern and Central Sierras, nearly all of which are required for local use.

In conclusion, this company, if its proposition be favorably considered and accepted, will give a sufficient bond absolutely to guarantee to the city the supply indicated of seventy-five millions of gallons of water per day, with potential development to two hundred millions of gallons per day, at the price named. Water deliverable at the point of pipe line intake, and all water, water rights, reservoirs, and rights of way, and all works and constructions necessary to produce said supply of seventy-five million gallons per day (with potential capacity of two hundred million gallons per day as herein set forth) to be delivered and conveyed to the City and County of San Francisco for said price, free and clear of all liens and encumbrances and title clear.

Respectfully submitted,

BAY CITIES WATER COMPANY,

By WILLIAM S. TEVIS, President.

April 9, 1906.

EXHIBITS

A, B, C, D, E, F, G, H, I and K

ACCOMPANYING

PROPOSITION

— OF —

BAY CITIES WATER COMPANY.

EXHIBIT A

WATER APPROPRIATIONS.

The water rights included in this proposition embrace all rights of the El Dorado Water and Deep Gravel Mining Company and its predecessors in interest, to the waters of the South Fork of American River and its tributaries available to the intake of the canal (built by that company and its predecessors), in Section 29 of Township 11 North of Range 15 East, M. D. M., El Dorado County, California. Also to all of the water rights of Bradley, Berdan and Company; Jones, Furman and Company, Eureka Canal Company, Park Canal and Mining Company, and others constituting the Diamond Ridge Ditch System, to the waters of North Fork of Cosumnes River and its tributaries above Buck's Bar, in Section 7 of Township 9 North of Range 12 East, M. D. M., El Dorado County, California.

The appropriations of water here cited are of necessity confined to those appearing upon the official records. The water rights, however, were principally acquired by location and use in 1851 and 1852, at which time recordation of appropriations was not provided for by law. Use under these appropriations has continued without interruption to the present time, and these rights include substantially all the waters of the territory above referred to.

In the following schedule quantities of water appropriated are stated in miner's inches; 77.37 such inches are the equivalent of 1,000,000 gallons per day.

AMERICAN RIVER GROUP.

Located.	Miner's Inches.	Waters of Stream or Lake.
6 May, 1872.	20,000	Martin's Lake.
6 May, 1872.	20,000	Silver Lake.
6 May, 1872.	20,000	Red or Clear Lake.
6 May, 1872.	20,000	Audrain's Lake.
6 May, 1872.	20,000	Lakes and Ponds of Slippery Ford branch of South Fork American River.

AMERICAN RIVER GROUP.—Continued

7 May, 1872.	10,000	Alder Creek.
7 May, 1872.	500	Mill (sometimes called Wolf) Creek.
7 May, 1872.	500	Mill (sometimes called Wolf) Creek.
7 May, 1872.	5,000	Plum Creek.
13 May, 1872.	10,000	Echo Lakes and Creek.
16 May, 1873.	10,000	Alder Creek.
16 May, 1873.	10,000	Plum Creek.
16 May, 1873.	10,000	Echo Lakes.
16 May, 1873.	10,000	Silver Lake.
16 May, 1873.	10,000	Red or Clear Lake.
16 May, 1873.	10,000	Martin's Lake.
16 May, 1873.	10,000	Audrain's Lake.
16 May, 1873.	10,000	Slippery Ford branch of South Fork American River.
16 May, 1873.	10,000	Strawberry Creek.
16 May, 1873.	10,000	All lakes and streams furnishing water to South Fork American River.
16 May, 1873.	4,000	Silver Lake.
16 May, 1873.	5,000	Echo Lakes.
17 May, 1873.	4,000	Audrain's Lake.
28 September, 1874.	All waters.	Plum Creek.
25 October, 1875.	All waters.	Medley Lakes and tributaries.
23 November, 1875.	10,000	Twin Lakes.
17 June, 1899.	10,000	Medley Lakes at outlet.
11 October, 1899.	10,000	Lake Henry, or Lake George.

COSUMNES RIVER GROUP.

Located.	Miner's Inches.	Waters of Stream or Lake.
2 July, 1872.	200	Sly Park Creek.
25 September, 1873.	6,000	North Fork Cosumnes River.
25 September, 1873.	6,000	North Fork Cosumnes River.
25 September, 1873.	6,000	Park Creek.
25 September, 1873.	6,000	Camp Creek.
25 September, 1873.	6,000	Camp Creek.
8 January, 1875.	6,000	Camp Creek.
8 January, 1875.	6,000	Park Creek.
8 January, 1875.	6,000	North Fork Cosumnes River.
8 January, 1875.	300	Sly Park Creek.
17 April, 1875.	6,000	North Fork Cosumnes River.
17 April, 1875.	6,000	Park Creek.
17 April, 1875.	6,000	Camp Creek.
30 August, 1875.	2,000	Sly Park Creek.
25 September, 1875.	4,000	North Fork Cosumnes River.
25 September, 1875.	4,000	Camp Creek.
10 December, 1877.	500	Steeley's Fork Cosumnes River.
	10,000	North Fork Cosumnes River.

EXHIBIT B

RESERVOIR APPROPRIATIONS.

Schedule of reservoir appropriations upon South Fork of American River and the lakes and streams and tributary thereto above the site of the projected tunnel connecting the American and Cosumnes watersheds.

Also of reservoir appropriations upon the North Fork of Cosumnes River and its tributaries above Buck's Bar.

These locations were made pursuant to the provisions of an act of Congress approved July 26, 1866.

NOTE—The appropriations here cited are largely renewals of unrecorded appropriations made prior to the passage of the act of March 27, 1872, requiring that such notices be recorded.

AMERICAN GROUP.

Date.	Reservoir Locations.
6 May, 1872	Martin's Lake.
6 May, 1872	Silver Lake.
6 May, 1872	Red or Clear Lake.
6 May, 1872	Audrain's Lake.
7 May, 1872	Alder Creek.
7 May, 1872	Mill Creek.
7 May, 1872	Plum Creek.
13 May, 1872	Echo Lakes.
16 May, 1872	Silver Lake.
16 May, 1872	Echo Lakes.
17 May, 1873	Audrain's Lake.
28 September, 1874	Plum Creek.
25 October, 1875	Medley Lakes.
23 November, 1875	Twin Lakes.
23 November, 1875	Alpine Creek.

COSUMNES GROUP.

Dated.	Reservoir Locations.
25 September, 1873	Park Ranch.
25 September, 1873	Hazel Valley.
25 September, 1873	North Fork Cosumnes River.
16 December, 1874	Sly Park Creek.
18 October, 1883	Camp Creek.

EXHIBIT C.

RESERVOIRS FOR DAILY SUPPLY OF SEVENTY-FIVE MILLION GALLONS.

The first three of the following named reservoirs have been constructed and in continuous use for many years. The fourth is to be constructed by these proponents. These four reservoirs, having an aggregate capacity of fourteen thousand and fifty-eight million gallons, will provide the storage necessary to a continuing daily draft of seventy-five million gallons. The reservoirs are viz.:

#1—SILVER LAKE.

This lake is situated in Townships 9 and 10 North of Range 17 East, M. D. M., Amador County, California, at the headworks of Silver Fork of South Fork of American River and at elevation about 7,800 feet above the sea.

It has been improved and continuously used as a reservoir for more than thirty years; and, as improved, has an available storage capacity for one thousand nine hundred and fifty million gallons of water, which can be very considerably increased at moderate cost.

#2—THE ECHO LAKES.

Comprising Big and Little Echo Lakes, which are connected by a channel. The location is in Townships 11 and 12 North of Range 17 East, M. D. M., El Dorado County, California, and at elevation about 7,400 feet above sea level.

The natural drainage is into the Upper Truckeee River, thence to Lake Tahoe and to the Humboldt Desert. Many years ago, however, the divide was tunneled and the waters brought into the head of South Fork of American River in connection with the waters of which they have since been continuously utilized. The available storage capacity of these lakes, as at present improved, is six hundred and eight million gallons of water. This capacity can be largely increased when needed.

#3—THE MEDLEY LAKES.

This group of lakes, known as "The Devil's Basin," is situated in Township 12 North of Ranges 16 and 17 East, M. D. M., El Dorado County, California, an elevation above tidewater of about 8,400 feet. The basin comprises thirty or forty small lakes hollowed out of solid granite by glacial action, and connected together by narrow channels. They have been converted into a reservoir by the erection of a dam across their common outlet, Pyramid Creek; and, as improved, provide available storage for eight hundred million gallons of water. This available storage capacity is readily susceptible of material increase at very low cost.

#4—SLY PARK RESERVOIR.

This reservoir, to be constructed by these proponents by erection of dams, etc., as later set forth herein, on Park and Hazel Creeks, is to be located in Township 10 North of Range 13 East, M. D. M., El Dorado County, California, and at elevation about 3,500 feet above the sea. It will be so situated that, in addition to its natural tributary drain area, the entire drain area of the upper South Fork of American River and Upper Camp Creek, become tributary to it. The available capacity of this reservoir under first improvements, will be ten thousand seven hundred million gallons.

EXHIBIT D.

RESERVOIRS FOR DAILY SUPPLY OF TWO HUNDRED MILLION GALLONS.

As the water requirements of the city from time to time increase beyond a daily consumption of seventy-five million gallons, it will be necessary to increase the aggregate storage capacity of the mountain reservoirs from the total of fourteen thousand and fifty-eight million gallons, provided as per Exhibit C, to a grand total of fifty thousand eight hundred and ninety million gallons. To enable this increase when and as required, the following reservoir sites are to be utilized, viz:

#1—SILVER LAKE.

The location of this reservoir is stated in Exhibit C. In its ultimate development, through raising the height of the dam, its water retaining capacity can be increased four thousand one hundred and fifty million gallons, providing it an ultimate available storage of six thousand one hundred million gallons.

#2—TWIN LAKES.

These lakes are situated in Township 10 North of Ranges 17 and 18 East, M. D. M., Alpine County, California, at elevation 7,900 feet above the sea. They are the source of Alpine Creek, a tributary of the Silver Fork of South Fork of American River. The waters flowing therefrom have been utilized for many years, and the lakes have been controlled for reservoir purposes since prior to 1875. Improvements of moderate cost will give an available water storage capacity of six thousand three hundred million gallons.

#3—AUDRAIN LAKE.

Is located in Township 11 North, Ranges 17 and 18 East M. D. M., El Dorado County, California, at elevation 7,200 feet and is the upper lake source of South Fork of American River. Its waters have been in constant use for a long series of years, but no dam has been erected for restraining storm water flows. By constructing necessary dams, gates, etc., for the installation of which prime natural advantages exist, the lake can be made to provide available storage for one thousand five hundred and seventy million gallons of water.

#4—THE ECHO LAKES.

For description of location, altitude, etc., see Exhibit C. Through increase of height of dam the original storage capacity of six hundred and eight million gallons can readily be increased to two thousand four hundred and fifty million gallons.

#5—THE MEDLEY LAKES.

The characteristics, location and altitude of these lakes are set forth in Exhibit C. By raising height of existing dam, which can be done at very low cost, the original storage capacity can be increased to three thousand million gallons.

#6—CAPP'S CROSSING.

This reservoir site is located on the North Fork of Cosumnes River in Township 9 North of Range 14 East, M. D. M., El Dorado County, California, at an elevation above sea level of about 5,100 feet. It is an admirable site and, when improved, will provide storage for one thousand six hundred and fifty million gallons of water.

#7—GRANITE BASIN.

The Granite Basin reservoir site is located on Camp Creek in Township 10 North of Range 15 East, M. D. M., El Dorado County, California, at elevation about 4,000 feet. The site is first-class and by easily made improvements, will provide storage for one thousand one hundred and twenty million gallons of water.

#8—SLY PARK.

The location and elevation of this reservoir are fully set forth in Exhibit C, and while quite feasible to do so, the calculations made do not contemplate any increase of the ten thousand seven hundred million gallons capacity there stated.

#9—BUCK'S BAR.

This reservoir site is on North Fork of Cosumnes River in Township 9 north of Range 12 East, M. D. M., El Dorado County, California, at 1,500 feet elevation above sea level. The site is exceptionally fine, and the damsite a wonderful gorge of solid granite. When improved to its capacity, it will store eighteen thousand million gallons of water.

It is proper to direct attention to the fact that the relative locations of the several reservoirs above described is such that, taken together, they form a remarkably flexible system. Thus, the waters of Silver, Twin and Audrain Lakes may be transferred to Sly Park or Buck's Bar; those of Echo Lakes to Audrain Lake, Sly Park or Buck's Bar; those of Medley Lakes to Sly Park or Buck's Bar; those of Capp's Crossing to Sly Park or Buck's Bar; those of Granite Basin to Sly Park or Buck's Bar, and those of Sly Park to Buck's Bar. The waters of eight of the nine reservoirs, to-wit: Twin, Silver, Audrain, Echo and Medley Lakes, Capp's Crossing, Granite Basin and Sly Park can be delivered at the pipe line intake either by the High or Low Line Canal; Buck's Bar alone being confined to the Low Line.

EXHIBIT E.

DAMS FOR DAILY SUPPLY OF SEVENTY-FIVE MILLION GALLONS.

The dams which are now in place creating the reservoir at Silver, Echo and Medley lakes (see items 1, 2 and 3 of Exhibit C), are variously described as follows:

(1) SILVER LAKE DAM.

The dam across the natural outlet of Silver Lake creating the present storage for water, is a simple but substantial rock-crib structure. It is equipped with appliances for controlling the discharge when the level of the lake is not above the spillway; when above that level the water runs to waste, except as it may be recovered at the American Canal headworks.

The dam has been in use for many years, and while not elegant is thoroughly effective. The present water-storage capacity of the reservoir, as stated, is one thousand nine hundred and fifty million gallons, but economically susceptible of increase to six thousand one hundred million gallons, and probably more.

(2) ECHO LAKES DAM.

The existing dam across the natural outlet of the Echo Lakes is a substantial structure fully ample to meet the storage requirements of the present and for several years to come. It is what is known as a "one-man boulder" dam filled with earth, and retains in store the six hundred and eight million gallons of water referred to in connection with the Echo Lakes reservoir.

The dam is equipped with the necessary gates for controlling the flow of water from the lakes, and is serviceable for many years. When increase of storage is necessary at this point to provide against an increase in the city's water requirements, a dam of required height can readily be constructed, and at moderate cost, increasing the storage capacity to two thousand four hundred and fifty million gallons. The natural facilities for construction are first-class.

(3) MEDLEY LAKES DAM.

The waters impounded in the Medley Lakes are restrained by a rock-fill dam erected across the natural outlet. This structure has been in place since 1899, and fully meets all requirements. Material for its enlargement when increased storage capacity is desired, is immediately at hand, and the natural facilities for building a high dam are ideal. A comparatively small investment would construct a dam which would quadruple the present storage capacity of the lakes, bringing it up from eight hundred million gallons as at present, to about three thousand million gallons.

(4) AMERICAN DIVERSION DAM.

At a point in the South Fork of American River in Section 28 of Township 11 North of Range 15 East, M. D. M., proponents will build across the channel of the stream a dam.

This dam will be of stone and concrete substantially constructed on approved designs and provided with all required and convenient accessories for its safety and for controlling the waters of the stream and diverting them into the intake works of the canal leading thence to the tunnel into the Cosumnes watershed, later described herein.

(5) SLY PARK DAM.

This structure is to be erected by proponents for the purpose of creating the additional storage requisite to the proper reserves against a continuing daily draft of seventy-five million gallons of water. It will be an hydraulic fill dam built about a steel re-enforced concrete core-wall, the upper face of the dam being properly protected against water action by a suitable facing of stone rip-rap. The dam will be such as to create the stated storage; it will have an ample and substantial spillway for the care of surplus waters, sluicing and draft pipes of proper dimensions will be supplied, and all necessary and convenient devices and appliances provided and installed conformable with the best engineering practices. The site for the dam is exceptionally fine and the materials at hand from which to construct it are of the very best quality.

This dam will create a storage reservoir having an available storage capacity of ten thousand seven hundred million gallons of water.

(6) HIGH LINE DIVERSION DAM.

Proponents will also erect a masonry dam across Camp Creek in Section 26 of Township 10 North of Range 13 East, M. D. M., for the purpose of diverting the waters from the channel of the stream into the High Line Canal leading thence to the point of pipe line intake. This dam will be of proper dimensions and design, provided with ample spillway for carrying away excess waters, equipped with all necessary and convenient water-controlling devices and safety appliances, and to be first-class in every respect.

EXHIBIT F.

WATER CONDUITS FOR DAILY SUPPLY OF SEVENTY-FIVE MILLION GALLONS.

The canals, ditches, tunnels, flumes and other conduits required to collect a daily supply of seventy-five million gallons of water from the various sources of supply, and to deliver the same to the point of pipe line intake, are as follows:

The natural channels of Alpine Creek, Silver Fork and South Fork of American River, and of Pyramid Creek and Slippery Ford Fork are to be utilized for conveying the waters of Silver Lake, Twin Lakes, Audrain Lake, Echo Lakes and the Medley Lakes, and their tributary drain areas, to the headworks of the American Canal, later described. These channels have been continuously utilized for this purpose for more than twenty-five years, and the right is a vested one.

All of these upper American waters, except those of the Echo Lakes, flow naturally to the canal intake. The Echo Lakes waters are discharged into a conduit consisting of a flume, ditch, tunnel and open channel, and are conducted through the western summit of the Sierra Nevada range of mountains and discharged into the channel of South Fork of American River. These works were originally constructed many years ago and have since been continuously used.

By the above means all the waters originating above the head of the American canal are concentrated in the channel of South Fork of American River at a point in Section 29 of Township 11 North of Range 15 East, M. D. M., where the American diversion dam (to be erected by proponents as per Exhibit E) will divert them into the canal.

The part of the canal of the El Dorado Water and Deep Gravel Mining Company, here called the "American canal," embraced in this proposition, extends from the point above named to the entrance of a tunnel, later described, connecting the American and Cosumnes watersheds in Section 34 of Township 11 North of Range 13 East, M. D. M.

The length of this canal from end to end as above, inclusive of flumes in line, is about 102,960 feet. Of this length about 22,000 feet is made up of 37 flumes of varying length. The remainder, about 81,000 feet, being regular canal section excavated in earth and stone.

The canal has been built and in continuous use for more than thirty years. It was given an original carrying capacity of about one hnudred million gallons of water per day. The engineer who made the original location and under whose direction it was constructed, had the courage of his conviction that he was building for all time; the result being that he put the canal where it should have been put, built it as it should have been built, and provided it with ample sand boxes, waste wiers, and other necessary appliances. The good work done has now the seasoning of time, coupled with good maintenance; and to-day, as nearly as may be, it possesses the characteristics and stability of a natural channel. Sand boxes, waste wiers, and other protective devices are placed at frequent intervals along the canal line.

The character of the construction and the natural conditions are favorable to an economical enlargement of the canal section and carrying capacity, which can readily be increased to deliver about two hundred million gallons of water per day.

In the line of the canal a number of ravines were encountered, to cross which flumes were necessary. These flumes begin and end on substantial stone abutments which were well designed and constructed, and are in prime condition. The aggregate length of flumes in the canal section above referred to, is 22,000 feet, of which about 11,000 feet are new, having been rebuilt within the past three years. The remainder is serviceable for a time, but is being rebuilt as occasion requires.

The rights of way of the canal line are 60 feet in width, being 30 feet from each side of the center line as located. These were secured under act of Congress when the canal was constructed, and have been in peaceable possession for nearly fifty years, hence are perfect. The canal is to be put into condition by proponents as indicated by Exhibit K.

Commencing at a point on the canal line in Section 34 of Township 11 North of Range 13 East, M. D. M., and extending thence through the divide between the watersheds of the South Fork of American River and North Fork of Cosumnes River, proponents will construct a tunnel for the purpose of discharging the waters of the canal into the Sly Park reservoir.

The length of this tunnel will approximate 2,000 feet. It will be provided with suitable masonry entrance and discharge portals, and will be concrete lined on sides and bottom and overhead where necessary. The tunnel will be given capacity for its ultimate requirements of about two hundred million gallons of water per day, and will be designed and constructed in accordance with approved plans and specifications, equipped with proper gates and other appliances of safety and convenience, and be first-class in every respect.

The waters from the American watersheds and from Sly Park reservoir will follow the channels of Sly Park and Camp Creeks to the High Line diversion dam (see Exhibit E), where they will be diverted into the High Line canal leading thence to the pipe line intake.

The canal to be utilized for this purpose is the old Jones and Furman ditch, constructed nearly fifty years ago and since used for the conduct of water. This canal originates on Camp Creek in Section 26 of Township 10 North of Range 12 East, and extends thence to a point in Section 2 of Township 9 North of Range 11 East, from which point these proponents will construct a new canal to a point in Section 19 of the same Township and Range, which will be convenient to the pipe line intake and at such an elevation above it as to enable development of power as stated in the twelfth paragraph of proponents' proposition.

The canal will be reconstructed by these proponents from intake to discharge. All headworks, flumes, waste wiers, safety devices, conveniences, etc., being supplied and installed in accordance with approved plans and specifications. The completed canal to have capacity to deliver one hundred million gallons of water per day at the pipe line intake.

EXHIBIT G.

RIGHTS OF WAY.

In addition to the channel, ditch and canal rights of way referred to and described in Exhibit F, to-wit: The channels of Alpine Creek, Silver Fork of South Fork of American River, Pyramid Creek, Slippery Ford branch of South Fork of American River, South Fork of American River, Echo Lakes ditch line, American canal, Jones and Furman canal, etc., these proponents' proposition embraces the following channels and rights of way:

The channels of Mill or Wolf Creek, Alder Creek and Plum Creek, originally tributaries to South Fork of American River but now tributary to the American canal.

The channel of Camp Creek from Granite Basin reservoir site to the intake of the Jones and Furman canal in Section 26 of Township 10 North of Range 12 East, M. D. M.

A ditch line connecting the channel of Camp Creek in Section 24 of Township 10 North of Range 13 East, M. D. M., with the sly Park reservoir site.

A ditch line connecting the North Fork of Cosumnes River in Section 18 of Township 9 North of Range 13 East, M. D. M., with the channel of Camp Creek and the Jones and Furman canal.

A canal line extending from the Buck's Bar damsite along the north bank of North Fork of Cosumnes River to a point in Section 19 of Township 9 North of Range 11 East, M. D. M., being the point of intake for pipe lines leading thence to the City and County of San Francisco. This covers the location of the so-called Low Line canal.

EXHIBIT H.

Description of Watersheds.

The zone of the watersheds comprises an area of 396.53 square miles. It stretches from Cat Point, about eight miles southeast of Placerville, eastward about forty miles to the summit of the high Sierras, and embraces the slopes of two spurs of mountains, having a width of from ten to sixteen miles. Its topographical aspect is typically Sierran, rising from an elevation of 1500 feet, it culminates in altitudes of more than ten thousand feet at the summits of Pyramid Peak, Round Top and Mount Tallac and other high mountains included in the area.

The lower reaches are well wooded with many varieties of conifer, admirably adapted to the conservation of moisture; the upper reaches are granitic, broken and glaciated, stripped of soil, clean and cold, blanketed with perennial snows. Vast reservoirs of water thus lie congealed upon these elevations throughout the year, and yield a continuous flow during the season of greatest heat and drouth.

Only a few spots in this entire territory are susceptible of human habitation, the total population at present aggregating not to exceed three hundred and fifty persons—less than one to a square mile of the tract under consideration. Of these persons nearly all are settled upon flats which comprise the reservoir sites and would, perforce, remove when these spaces become converted to the uses of the city.

About three-fourths of this area has been withdrawn from settlement through being included within the Tahoe Forest Reserve. It is patrolled by forest rangers in the employ of the Government, whose duty it is to prevent trespass and to protect the timber against fires, thereby maintaining those conditions of the watershed favorable to the largest conservation of water, to continuance of running streams and their freedom from pollution. The precipitation is very copious, the watersheds lying for the most part within the lines marking one of the regions of greatest rainfall in the Sierra Nevada mountains. By reason of the cool climate evaporation is at its minimum, and the surfaces being largely naked rock, there is a maximum runoff; thus the catchment is productive of large quantities of water seemingly disproportionate with its area. The conditions throughout are favorable in the highest degree to great precipitation upon surfaces where the waters may lie or be held free from contamination and from which they may be released in their pure state as the needs of the city may require.

EXHIBIT I.

Analyses of Water.

Professor Thomas Price of San Francisco, to whom was submitted for analysis four samples of water taken from widely separated portions of the watershed, has issued the following certificate:

"THOMAS PRICE & SON,
"Analytical & Consulting Chemists,
"509 Commercial St.,
"San Francisco.

"November 6th, 1905.

"Analyses of 4 Samples of Water for Bay Cities Water Company.

	"SILVER LAKE.	ECHO LAKE.	DITCH.	BUCK'S BAR.
	"Grains "per Gal.	Grains per Gal.	Grains per Gal.	Grains per Gal.
"Calcium Carbonate	0.872	0.651	0.405	2.426
"Magnesium Carbonate.......	Trace	0.092	0.273	0.518
"Sodium Chloride	0.320	0.151	0.421	0.256
"Potassium Chloride	0.123	0.108	0.274	0.125
"Organic Matter	Trace	Trace	Trace	Trace
"Total Residue	1.315	1.002	2.373	3.325
	"Parts per "Million.	Parts per Million.	Parts per Million.	Parts per Million.
"Free Ammonia	0.032	0.002	0.011	Trace
"Albuminoid Ammonia	0.039	0.025	0.021	0.020
"Nitrates	None	None	None	None
"Nitrites	None	None	None	None
"Hardness:				
"Temporary as Ca CO3	15	13	29	43
"Permanent	None	None	None	None

"All of the samples were free from either color or odor, and none of them contained any sediment.

"The foregoing analyses show these waters to possess a degree of purity which is not equalled by that supplied to any large city in the world.

(Signed) "THOMAS PRICE & SON."

EXHIBIT K.

Schedule of Improvements Which Bay Cities Water Company Will Create Upon Properties Included in its Proposition.

One: Deepen the channel connecting Big and Little Echo Lakes to a point on a level with the present outlet of Big Echo Lake.

Two: Repair existing dam on Big Echo Lake and replace headgates at the outlet with new gates of substantial construction.

Three: Overhaul, repair and replace flume now connecting Echo Lake outlet with ditch leading to tunnel; clean out ditch and repair portals to tunnel.

Four: Overhaul Medley Lakes dam and put in new and substantial outlet gates.

Five: Put in new low diversion dam of concrete or masonry construction across South Fork of American River at head of American River canal.

Six: Replace existing headworks of American canal with new substantial structure, inclusive of gates for governing inlet of water to canal, and proper provision for waste of excess water.

Seven: Clean out American canal and so increase the carrying capacity thereof through deepening and widening channel by excavation and raising of berm, as to give it a carrying capacity of not less than one hundred million gallons per day.

Eight: Inclusive of all improvements to be made by these proponents as in this exhibit set forth, to make such provisions as good engineering practice prescribes for the delivery of a continuing daily supply of seventy-five million gallons of water at the lower end of the High Line canal hereinafter described. Said provisions to be made either by adding to the capacities of the reservoirs described in the preceeding Exhibit C or by otherwise creating additional storage above the intake of the High Line canal and by increasing the earth and rock sections of the American canal to a carrying capacity of not less than one hundred million gallons per day; repairing such of the existing flumes thereon as are in good condition; and replacing such as require replacing, and giving all said flumes a carrying capacity of at least one hundred million gallons per day, or alternatively, by a combination of increase of storage and of canal carrying capacity as these proponents shall elect.

Nine: Build such suitable waste water wier on line of American canal adjacent to inlet of tunnel connecting American and Cosumnes watersheds, as shall be necessary to dispose of excess water accumulating at that point.

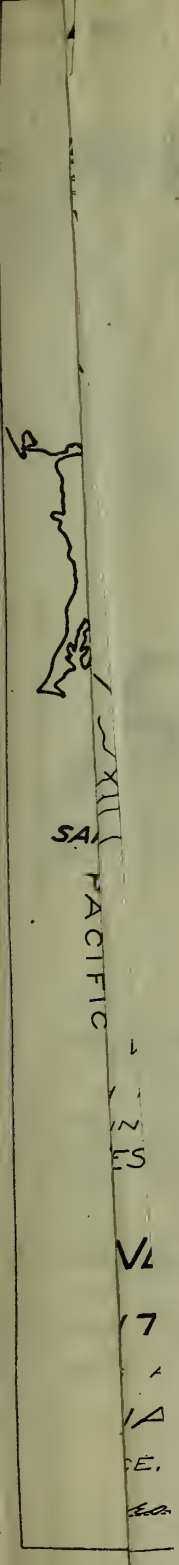
Ten: Build tunnel through divide between American and Cosumnes watersheds. Said tunnel to be of full concrete construction with suitable concrete entrance and discharge portals; to have a capacity of two hundred million gallons per day; and to be provided with all necessary gates for controlling the entrance of water thereto.

Eleven: Remove buildings, fences, trees, etc., from the site of the Sly Park reservoir, and put same in proper sanitary condition for storing water for human consumption.

Twelve: Construct necessary earth-fill dams with concrete core-walls of sufficient heights, to create storage in Sly Park reservoir for ten thousand seven hundred million gallons of water. Said dam to be provided with proper gates for controlling the discharge from said reservoir and proper gates, pipes, etc., for sluicing the same. Also to be provided with proper spill-way for discharge of excess water and all requisite safety devices.

Thirteen: Construct a suitable masonry diversion dam across Camp Creek at head of High Line canal, leading thence to the common point hereinabove referred to. Said dam to be equipped with proper sluice gates, pipes, and safety devices and appliances.

Fourteen: Clean out, enlarge, reconstruct and extend the High Line canal extending from the diversion dam next above referred to; building all flumes, tunnels, etc., necessary to said canal line and giving the same a carrying capacity of one hundred million gallons of water per day. Said canal to be equipped with all necessary headgates, waste wiers, etc., and to terminate at a point sufficiently above the point chosen for headworks of pipe lines extending thence to the city, to enable the development of power as above stated and the discharge of the waters into pipe lines extending to the City and County of San Francisco.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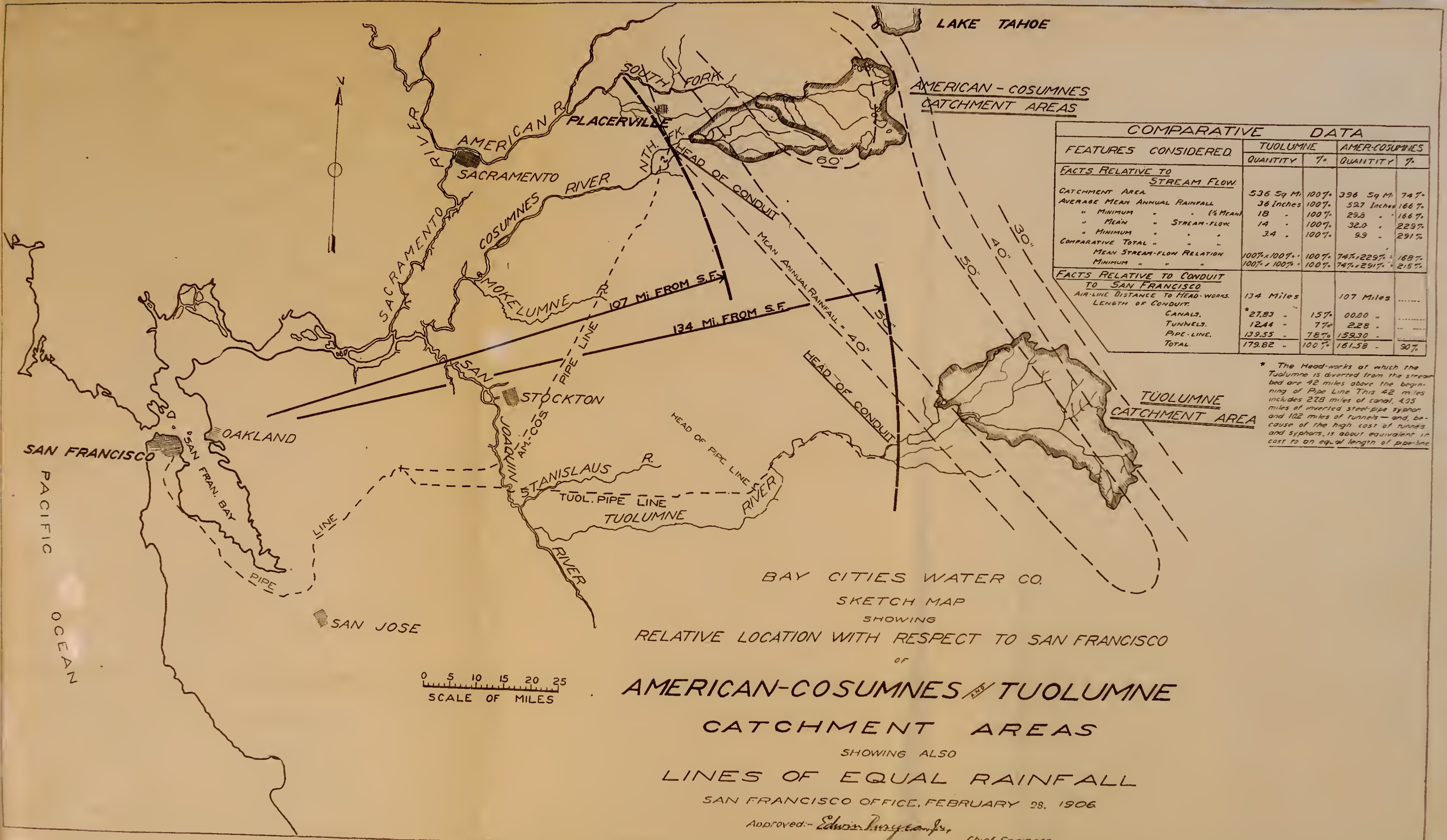


COMPARATIVE DATA

FEATURES CONSIDERED.	TUOLUMNE		AMER-COSUMNES	
	QUANTITY	%	QUANTITY	%
FACTS RELATIVE TO STREAM FLOW.				
CATCHMENT AREA	536 Sq Mi	100%	396 Sq Mi	74%
AVERAGE MEAN ANNUAL RAINFALL	36 Inches	100%	52.7 Inches	166%
" MINIMUM " " (½ MEAN)	18 "	100%	29.8 "	166%
" MEAN " STREAM-FLOW	14 "	100%	32.0 "	229%
" MINIMUM " " "	3.4 "	100%	9.9 "	291%
COMPARATIVE TOTAL " " "				
MEAN STREAM-FLOW RELATION	100%×100% =	100%	74%×229% =	168%
MINIMUM " " "	100%×100% =	100%	74%×291% =	215%
FACTS RELATIVE TO CONDUIT TO SAN FRANCISCO.				
AIR-LINE DISTANCE TO HEAD-WORKS.	134 Miles		107 Miles	......
LENGTH OF CONDUIT.				
CANALS.	*27.83 "	15%	00.00 "	......
TUNNELS.	12.44 "	7%	2.28 "	......
PIPE-LINE.	139.55 "	78%	159.30 "	......
TOTAL.	179.82 "	100%	161.58 "	90%

* The Head-works at which the Tuolumne is diverted from the stream bed are 42 miles above the beginning of Pipe Line This 42 miles includes 27.8 miles of canal, 4.95 miles of inverted steel-pipe syphon and 10.2 miles of tunnels — and, because of the high cost of tunnels and syphons, is about equivalent in cost to an equal length of pipe-line

BAY CITIES WATER CO.

SKETCH MAP

SHOWING

RELATIVE LOCATION WITH RESPECT TO SAN FRANCISCO

OF

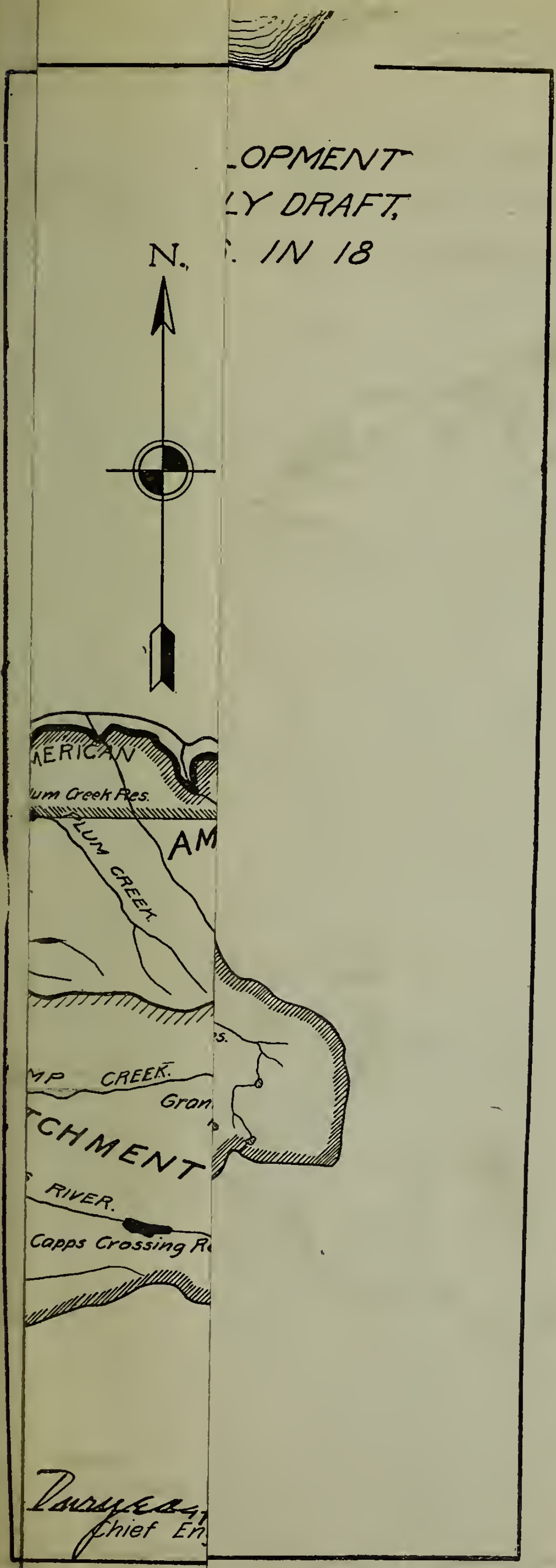
AMERICAN-COSUMNES AND TUOLUMNE CATCHMENT AREAS

SHOWING ALSO

LINES OF EQUAL RAINFALL

SAN FRANCISCO OFFICE, FEBRUARY 28, 1906

Approved:- Edwin Duryea Jr.,
Chief Engineer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MAP OF

AMERICAN – COSUMNES CATCHMENT AREA

OF

BAY CITIES WATER CO.

IN

EL DORADO, ALPINE AND AMADOR COUNTIES, CAL.

396 SQUARE MILES

OF

HIGH SIERRA CATCHMENT AREA

San Francisco Office, Feb. 21, 1907

STRUCTURES CONTEMPLATED FOR FINAL DEVELOPMENT AFFORDING OVER 300 MIL. GALS. DAILY DRAFT, WITH RESERVOIR STORAGE OF 104,900 MIL. GALS. IN 18 RESERVOIRS

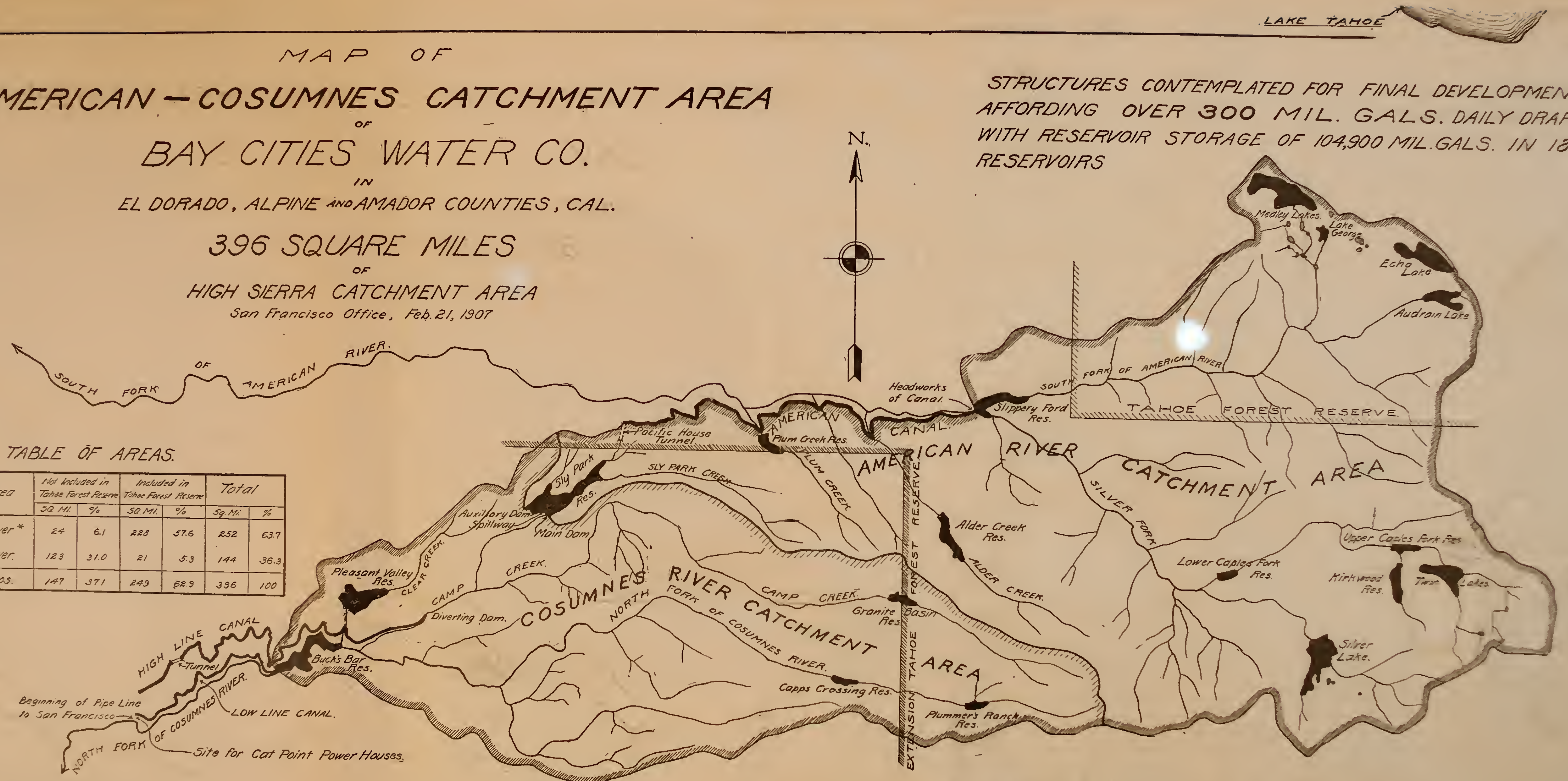

TABLE OF AREAS.

Catchment Area	Not Included in Tahoe Forest Reserve		Included in Tahoe Forest Reserve		Total	
	SQ. MI.	%	SQ. MI.	%	Sq. Mi.	%
American River *	24	6.1	228	57.6	252	63.7
Cosumnes River.	123	31.0	21	5.3	144	36.3
Total Am-Cos.	147	37.1	249	62.9	396	100

* Includes the 14 Sq. Mi. of Sly Park area in head-waters of Cosumnes, adjoining American River area. This 14 Sq. Mi. should be so included because the reservoirs and dams needed for its full development are included in the works furnished under the Bay Cities Water Co's offer.

Approved: Edwin Duryea Jr.
Chief Engineer